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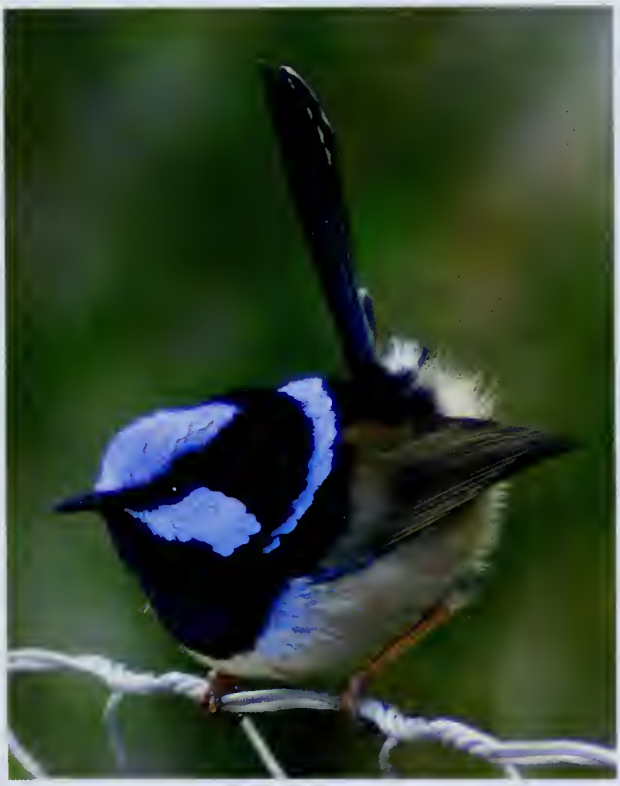

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From the Editors

After a highly successful incursion into the world of invertebrate conservation in the previous 'special' issue, we return to the more traditional range of subject matters. Molluscs, both marine and land, are represented in these pages, as are a Tasmanian record of the Elbow Orchid, a fossil coral and the Spotted-tailed Quoll. There is something here of interest to almost every naturalist.

Erratum

Our attention has been drawn to an unfortunate error in Martin O'Brien's paper on freshwater and terrestrial crayfish. Due to a production malfunction, the sequences of images on pages 216 to 218 and 220 to 221 were rearranged, thus creating a mismatch with the captions on those pages. The Editors regret this situation and apologise to the author for the error and to any readers who were inadvertently misled. Two inserts containing revised maps and captions, which readers can use to paste over the incorrect passages, are included with this issue.

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Front cover: Superb Fairy-wren *Malurus cyaneus*. Photo by Dan Carey Photography.
Back cover: A collection of shells from Bruxner Park, Coffs Harbour, NSW: top – *Hedleyella falconeri*; middle – *Thersites novaehollandiae* and Rhytididae species B; bottom – *Brazieresta larreyi* and Camaenidae species A. Photo by Michael Murphy. See p. 306.

Contributions to the palaeontology of the Yea area, central Victoria: I. the fossil coral *Pleurodictyum megastoma*

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Abstract
The tabulate coral *Pleurodictyum megastoma* McCoy is one of the most characteristic fossils of the Late Silurian to Early Devonian marine sedimentary rocks of central Victoria, Australia. This is the first record of occurrences of this fossil in the distal turbidite facies of the Yea area, which have previously been controversially dated as Late Silurian. Two of the three localities at which it has been found appear to contain Early Devonian fossil assemblages typical of central Victoria. A lectotype specimen of *P. megastoma* is designated and assigned a Pragian-Emsian (Early Devonian) age but other specimens have been recorded from Silurian sediments. (*The Victorian Naturalist* **124** (5), 2007, 288-295)

Introduction

The fossil coral *Pleurodictyum megastoma* was first named in a French translation of some notes by McCoy (1866), produced as a pamphlet for the Intercolonial Exhibition of Australasia held in Melbourne from 23 October 1866 to 9 February 1867. It has since received attention in a number of papers, notably those by Withers (1932) and Neil (1985). Moulds of this coral occur widely in marine sediments of Siluro-Devonian age in the Melbourne and Tabberabbera Zones of central Victoria. It is immediately recognisable, in its most characteristic form, by the circular outline of the corallum which is made up of large polygonal corallites, radially lengthened the further they are from the centre, and connected by large pores. Entire specimens of this distinctive coral are commonly found; one illustrated by Neil (1985) has 40 corallites and measures 4.5 cm across.

The Yea area has long been known to contain marine clastic sediments of Siluro-Devonian age (Couper 1965). A fold structure, the Yea Anticline, reportedly contains the oldest fossils, which are graptolites of Ludlow-Pridoli (Late Silurian) age (Garratt 1978; Garratt and Rickards 1984, 1987; Rickards and Garratt 1990; Rickards 2000), and elsewhere in this area are found graptolites of Pragian (Early Devonian) age (Jaeger 1966; Garratt 1978). The Late Silurian date is controversial (Hueber 1992; Rickards 2000) because of the occurrence of the advanced fossil plant *Baragwanathia* with the graptolites. Similar plants are not known elsewhere until the Early Devonian.

As part of research into the stratigraphic context of the *Baragwanathia* flora, a detailed field study has been made of the Yea area. This has resulted in the finding of a number of localities at which moulds of identifiable calcareous fossils occur. There has been no previous substantial report of such fossils from the Yea area, which has generally been perceived as being fairly barren apart from the few plant-graptolite localities. This is because the sediments are deep-water shales (which contained no resident calcareous organisms) and turbiditic sandstones (in which fossils are too fragmented to identify). The very rare Yea specimens of *Pleurodictyum* represent individuals which have been preserved by fortuitous circumstances in the midst of unfavourable conditions. By contrast, the previously well-known occurrences of *Pleurodictyum* are usually from mudstones, or other relatively near-shore sediments, where the animals either grew on the spot or were transported relatively short distances.

All fossil specimens and localities described in this paper are registered with Museum Victoria, denoted by registration numbers beginning NMV P and PL respectively.

Previous Studies

The sediments of the Yea area were originally described as Upper Silurian because of a general lithological similarity with

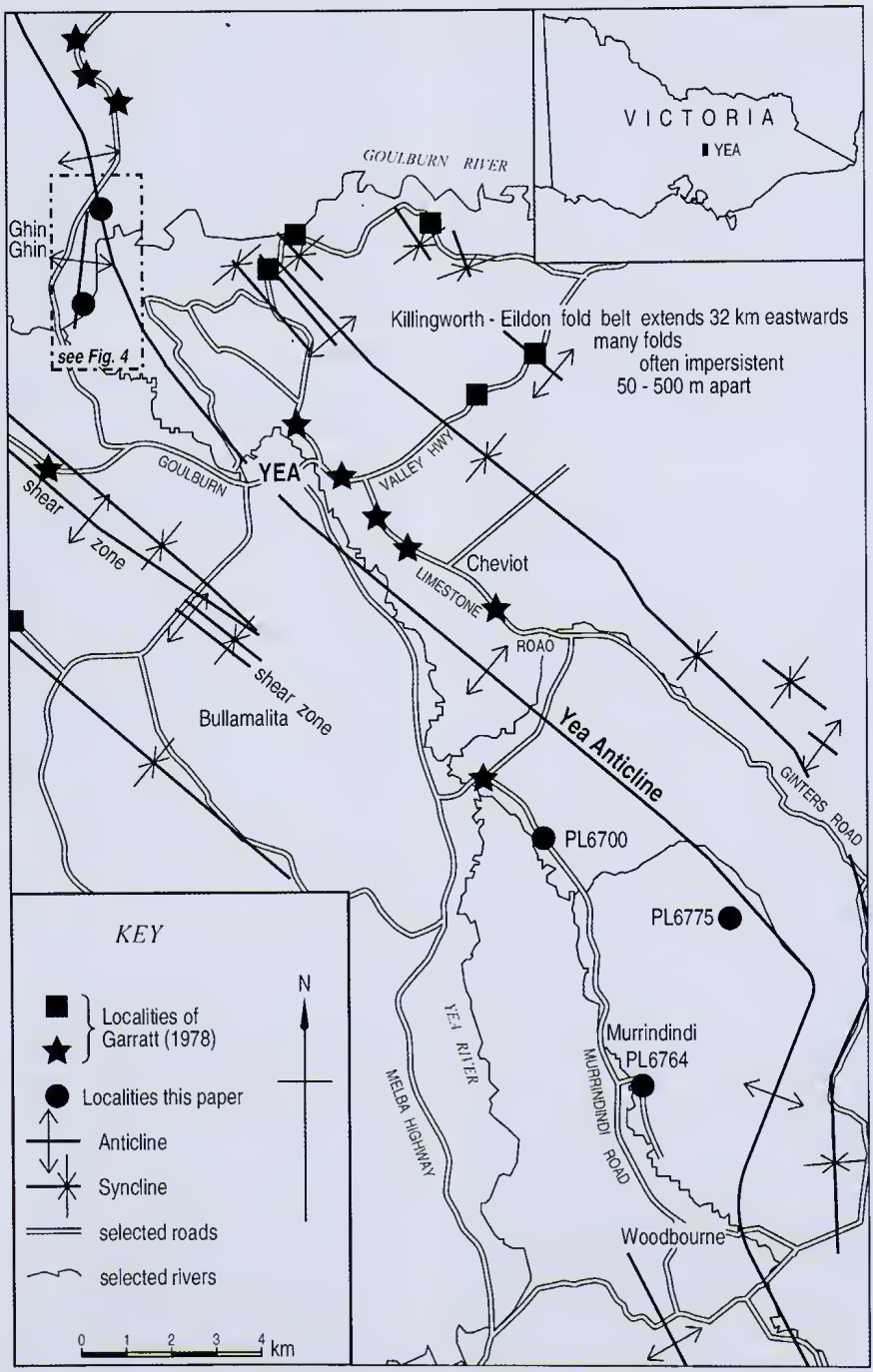


Fig. 1. Structural map of the Yea district showing the position of localities mentioned in the text. To facilitate comparison with previous papers on the geology of the Yea area, localities of Garratt (1978) have also been marked.

other strata in central Victoria, especially the absence of pronounced metamorphism (Selwyn and Ulrich 1866). Stirling (1895) reported Upper Silurian shelly fossils from a locality probably identical with NMV PL6765 of this paper. A study of the plant-graptolite fossil assemblage reported the close similarity of the distal turbidite and shale lithology of the Yea area to that of the Upper Yarra and Thomson River districts (Harris and Thomas 1941). 'Upper Silurian' in all these early studies corresponds with the Late Silurian-Early Devonian of current terminology.

Couper (1965) made the first detailed study of the Yea district and divided the sediments into three units labelled A, B and C. However, Couper's stratigraphy, although broadly correct, is not valid because it considers ill-defined fossil assemblages to delineate lithostratigraphic horizons. The consequences are particularly apparent on his mapping of the western limb of the Yea Anticline, where conglomerate and coarse sandstone (his loc. 64) are mapped on strike with laminated claystone (loc. 63), in contravention of lithostratigraphic principles, resulting in a considerable distortion of the boundaries of Unit A. Nevertheless, Couper's stratigraphy was accepted by Garratt (1978) with minor modifications, and the oldest unit, Unit A, was renamed the Yea Formation. This was assigned an Early-Late Ludlow (Late Silurian) age (Garratt 1983) with some suggestion that the base may lie within the Wenlock stage (Garratt *et al.* 1984). Garratt's stratigraphy is not currently accepted by the Geological Survey of Victoria (Edwards *et al.* 1997). However, the Geological Survey publications are inconsistent. Some maps (VandenBerg 1997a, 1997b; McDonald 1997) equate part of the Yea Formation with the near-shore Late Silurian Melbourne Formation and the rest with the siltstone of the Humevale Formation, both proximal or shelf facies (Sandford 2000, 2002); neither of these correlations is consistent with the lithology. On the other hand, it has also been stated that 'the Yea and Humevale formations in this area are now considered part of the lithologically variable Norton Gully Sandstone' (Edwards *et al.* 1997, p. 23) which is not older than late Pragian (VandenBerg 1975). At least this correlation is consistent with the distal turbidite and shale lithology, but ignores any palaeontological evidence.

In summary, the stratigraphy of the Yea area remains a matter of controversy as much as does the age of the sediments. Figure 1 of this paper should be compared with previous maps (Couper 1965; Garratt 1978; McDonald 1997; VandenBerg 1997b) for some idea of the current differences of opinion.

Localities

Specimens of *Pleurodictyum megastoma sensu lato* have been found at the following locations within the Yea area:

PL6700 Murrindindi Road

This is a low cutting on Murrindindi Road some 1.5 km south of the triple junction with Langs and Frog Ponds Roads and 10 km south of Yea. The bed in which the coral was found is a 7.5 m thick diamictite mass-flow deposit consisting primarily of mudstone with rare (< 0.1%) well-rounded pebbles and shale rip-up clasts. The rich shelly fossil assemblage includes the brachiopods *Boucotia australis* (Gill), *Leptostrophiella affinalata* (Gill), *L. alata* (Chapman), *Hysterolites lilydalensis* (Chapman), *Hipparionix major* Gill, *Australina lenticulata* (Philip) and *Tyersella typica* Philip, the bivalves *Praectenodonta raricostae* Chapman and *Cypricardinia crenistria* G and F Sandberger, the ostracode *Velibeyrichia wooriyallockensis* (Chapman), a species of the trilobite *Kettneraspis*, as well as proetid, aulacopleurid, acastid and phacopid trilobites, tentaculitoids and a rostroconch. The diamictite overlies a thinly laminated shale containing *Baragwanathia longifolia* Lang and Cookson, and is in turn overlain by thin-bedded siltstone and claystone. A similar though less well-preserved shelly assemblage occurs on strike to the south (loc. PL6764).

The illustrated specimen from PL6700 (Figs. 2, 3) is a mould of an almost complete corallum about 17 mm diameter containing 8 or 9 corallites, the largest of which has a maximum width of 7 mm. Part of the wrinkled basal holotheca has also been preserved. The measurements are

comparable with those recorded by Neil (1985). Another more fragmentary specimen from this locality has also been found. The locality has been mapped as Rice's Hill Sandstone (Garratt 1977, 1978) and as Melbourne Formation (VandenBerg 1997a; McDonald 1997), both of which have been assigned Ludlow (Late Silurian) ages. However, the lithology is inconsistent with either of these units. Moreover, the fossil assemblage reported here is characteristic of the Early Devonian of central Victoria, in particular the Late Lochkovian-Early Emsian of Lilydale-Seville-Woori Yallock, Tyers and Tabberabbera. It may be possible to give a more exact age determination when the tentaculitoids are extracted; however, the preservation of specimens so far recovered is not sufficient for positive identification.

PL6769 Quarry Hill

This is a sandstone turbidite outcrop on the east side of the Quarry Hill ridge, near the junction of the Yea and Goulburn Rivers, 5.5 km north of Yea. The basal bed of the outcrop is remarkable for the large size of the fossil shell fragments and rip-up clasts, in comparison with other Yea turbidites. Shell fragments of *Leptostrophiella affinalata* (Gill) are abundant, and other fossils in the assemblage include *Notanoplia* cf. *pherista* (Gill), *N.* cf. *philipi* Garratt, *Maoristrophia keblei* Gill and *Australina lenticulata* (Philip). *Notanoplia* cf. *pherista* is also found at nearby locality PL6765 considered here to be at the same stratigraphic level. The notation 'cf.' indicates here that these notanopliids may in fact be *Boucotia australis* with the differentiating characteristics not preserved because of the coarse matrix.

The illustrated specimen from this locality (Fig. 5) is a fragment of a mould of a younger corallum than the previous. The maximum width of the only intact mature corallite is 5.5 mm. There are other specimens from this locality that may also be *P. megastoma*, but these have the corallites slightly smaller and more regularly shaped than is normally seen in this species. It is possible that these are ecotypes.

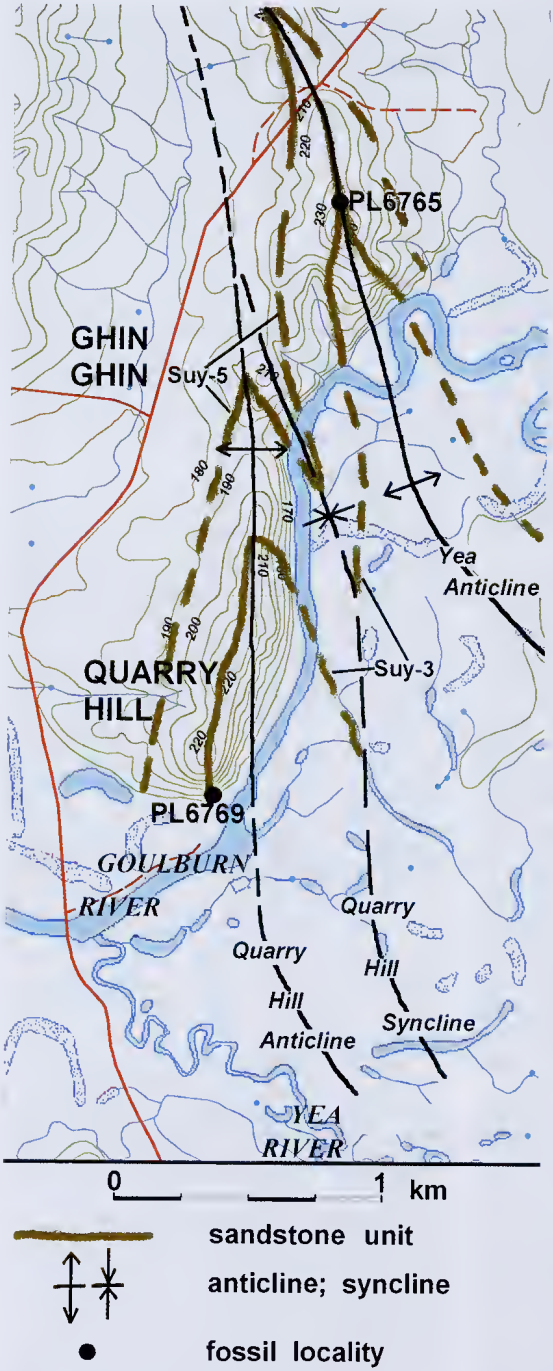
The locality has been mapped as Yea Formation in a sketch map (Garratt 1978) and as Humevale Formation (VandenBerg 1997a; McDonald 1997). However, the structure of this area differs considerably from that shown in these published reports. Prowse and Finlay (1988) mapped a previously unreported anticline along the ridge. This study has confirmed the existence of the anticline, and a syncline that separates it from the Yea Anticline a little further to the east (Fig. 4). I consider the turbidite outcrop to be a repeat of one of the marker sandstone turbidite members of the Yea Formation, here labelled Suy-3, and to be stratigraphically lower than PL6700. However, the fossil assemblage, and in particular the occurrence of triseptate notanopliid brachiopods, indicates that the age is still Early Devonian (Garratt and Wright 1988).

PL6775 Grant's Track

This is an outcrop in a gully off Grant's Track, Black Range State Forest, Murrindindi. The fossils occur in discontinuous thin lenses (possibly lag deposits) at the base of one fine-grained siltstone bed. Complete to almost complete brachiopod and gastropod shells are not uncommon. The assemblage includes unidentified species of the brachiopods *Gypidula*, *Macropleura* and *Leptaena*, and acastid and phacopid trilobite fragments. A notanopliid brachiopod similar to (but probably not identical with) *Notoparmella plentiensis* Garratt is also present.

The illustrated specimen (Fig. 6) is a mould of an almost complete corallum about 25 mm in diameter containing seven corallites, the largest of which has a maximum width of 10 mm. This specimen is also comparable in size with those recorded by Neil (1985).

The only previous record of fossils from this general area (the former Murrindindi goldfield) is a mention by Smyth (1869). The position of the locality is currently erroneously mapped as hornfels and on the wrong side of the Yea Anticline (VandenBerg 1997b). The outcrop is in a siltstone unit underlying Yea Formation marker unit Suy-3, and is therefore stratigraphically lower than PL6769. The absence of *Boucotia australis* and the presence of a notanopliid similar to *Notoparmella plentiensis* (Late Silurian: Garratt & Wright 1988) indicate a possible age range from Late Silurian to earliest



Early Devonian; this is consistent with the stratigraphy.

A problematic specimen

I must also note that the Museum Victoria collection of *P. megastoma* contains a mould of a large complete corallum (NMV P61758) in black fine-grained siltstone. Originally in the Creswell Collection, this is labelled 'From Yea presented by Miss Mary Taylor'. The lithology does not closely resemble any I have seen around Yea. At the time this specimen would have been collected, around the beginning of the twentieth century, the Taylors owned land in the area between Mt. Bullamalita and the Yea River. The limited natural outcrops in this area are generally of sandstone or slate, not at all resembling the matrix of this specimen. The Sunny Hills, Canadian and Halfway gold mines were operating in this area at that time, so it is possible it may have come from underground. But given the lack of a specific locality, this specimen is treated as being of doubtful provenance and is not considered further.

The type and age of *P. megastoma*

What age can be assigned to *P. megastoma*? In order to answer this question, it is first necessary to determine the type specimens because none has previously been designated. The original description (McCoy 1866) did not say anything about the new species other than 'ayant des cellules d'un

Fig. 4. Sketch map of the Ghin Ghin area showing structure, stratigraphy and fossil localities. Map base edited from digital topographic maps T7923-1-2-4 and T7923-1-3-1 downloaded from *www.land.vic.gov.au*. Standard legend for Victoria 1:30000 series maps applies in addition to the legend above. Suy-3 and Suy-5 label sandstone units within the Yea Formation.

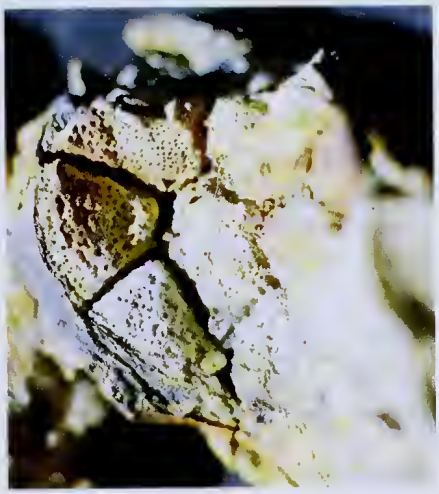


Fig. 2. *Pleurodictyum megastoma* specimen NMV P312893 from loc. PL6700, Murrindindi Road. View showing the corallites (×2).

Fig. 3. Counterpart of specimen NMV P312893 showing a fragment of the concentrically wrinkled basal holotheca (×2).

Fig. 5. *Pleurodictyum megastoma* specimen NMV P312894 from loc. PL6769, Quarry Hill, Ghin Ghin. View showing the corallites (×2).

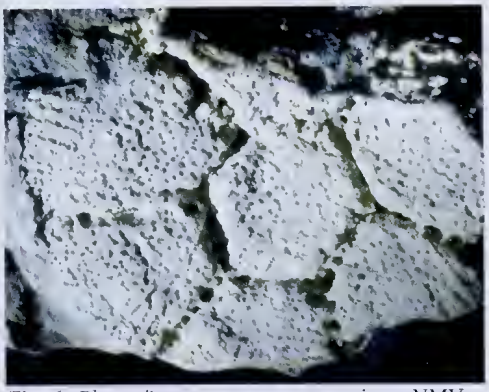


Fig. 6. *Pleurodictyum megastoma* specimen NMV P313991 from loc. PL6775, Grant's Track, Murrindindi. View showing the corallites (×2.2).

demi pouee de diamètre' ('having some cells half an inch in diameter'); no locations or types were mentioned. A later list of McCoy's Victorian fossils (in Smyth 1874) states that *P. megastoma* is from 'Upper Yarra', which in those days meant anywhere upstream from Warrandyte. The specimens were collected by government geologists in 1856 and given to McCoy for determination.

Chapman (1903) examined McCoy's specimens and found them to come from two localities. One, from a locality numbered B16 (NMV PL1875), he initially thought to have come from Kilmore, but this was later corrected (Chapman 1921). The real locality is described as '1½ miles downstream from Simmon's Bridge Hut on the Yarra'. The position of this locality is not known today, although Tom Darragh (pers. comm.) believes the bridge was near the old Tarrawarra railway station. Besides *P. megastoma*, the Museum Victoria collections include a number of other fossils from this site, including the brachiopod

Plectodonta bipartita. This, together with the lithology of the matrix surrounding the specimens, indicates that this locality is in the Humevale Siltstone of Lochkovian (Early Devonian) age.

The second locality, numbered B23 (NMV PL1834), is described as 'near Stewart's Station, junction of Woori Yallock Creek and Yarra River.' The position of this well-known locality has been described by Gill (1945). It is in the Yeringberg Formation of latest Pragian or early Emsian age (Sandford 2005).

I have re-examined McCoy's specimens for this study. Of the specimens from the first locality, it can be said that they are relatively immature, small, with few corallites, and more or less incomplete. The specimens from the second locality are larger and much more mature. The largest of them, a complete corallum NMV P340, was figured by Chapman (1903, Plate XVI, figs. 2, 4, 5), who noted that it had corallites up to 13 mm across – just a little over half an inch. It is likely that this is the specimen that so impressed McCoy with the size of its corallites that he decided to erect a new species. NMV P340 is here designated as the lectotype in order to establish a single name-bearing type for the species *Pleurodictyum megastoma* McCoy. Specimens NMV P341-345 from PL1834 and P346-348 from PL1875 are here designated paralectotypes. Plusquellec, who has studied *Pleurodictyum* and similar corals for many years, informs me (pers. comm. 2007) that he considers *P. megastoma* to be a species of *Ligulodictyum*, and had independently reached the same conclusion regarding the selection of lectotype.

Specimens of *P. megastoma sensu lato* have been reported from the Norton Gully Sandstone at Mansfield (Dun 1898) and from the Kilgower Member at Tabberabbera (Talent 1963), both of which are regarded as having the same age as the Yeringberg Formation (VandenBerg 1988).

Although the type would therefore be of Pragian-Emsian (Early Devonian) age, there are numerous reports of it from older sediments, down into the Silurian.

VandenBerg (1988) claims the oldest specimens come from the Bullung Siltstone of the Matlock area, which ranges from Late Wenlock to Early Ludlow. However, the fauna occurs in the upper part of that formation and may therefore be Ludlow. There are numerous reports from near Kilmore and Wandong (Dun 1898; Chapman 1903, 1921) which are probably from the Late Wenlock to Early Ludlow Yan Yean Formation. Specimens from Kilmore locality Bb20 (PL1674) were figured by Talent (1964), who thought that there were differences from *P. megastoma sensu stricto* and declined to assign them definitively to the species. This locality contains the internationally recognised index fossil *Monograptus ludensis* and is therefore definitely Late Wenlock in age (Rickards and Sandford 1998).

Conclusions

The occurrence of *P. megastoma* and associated fossils at localities north and south of Yea demonstrates the continuity of the Siluro-Devonian sediments of the Yea area with those occurring elsewhere in central Victoria.

Pleurodictyum megastoma does not in itself contribute to the controversy over the age of the Yea sediments, because although the type appears to be of Early Devonian age, specimens reportedly belonging to this species have in the past been obtained from sediments as old as Wenlock (Middle Silurian).

Acknowledgements

Melody Pepper assisted with the collection and extraction of the fossils. Former and present staff at Museum Victoria, Andrew McKay and Rolf Schmidt, provided curatorial assistance. David Holloway kindly identified the difficult trilobite material, and with Tom Darragh ransacked the Museum's files in an attempt to locate the position of B16. I also wish to thank an anonymous referee for suggestions, including that the type be formalised; and Yves Plusquellec (University of Brest) for his opinions on the taxonomy of the Victorian species.

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Notes on the external anatomy of nine pyramidellid marine snails (Gastropoda: Pyramidellidae) from Victoria

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Abstract
The live observation of nine species of pyramidellid marine snails from Victorian waters has allowed a report on their external anatomy. Brief notes on the family are also provided. (*The Victorian Naturalist* **124** (5), 2007, 296-305)

Introduction and methods

Recent intertidal records have allowed living pyramidellid marine snails from various Victorian localities to be studied. The animals have been legally collected by members of the Marine Research Group under permits held from Parks Victoria. They were kept alive in seawater and examined in this medium under the stereomicroscope, where notes and drawings were made. Specimens have been preserved in 70% ethanol and lodged in the Marine Invertebrate Department, Museum Victoria.

Summary of species examined

The higher classification below follows Bouchet and Rocroi (2005). Sub-family placements have been guided by the arrangement given in Schander *et al.* (1999).

Superfamily Pyramidelloidea
- Family Pyramidellidae
  - Subfamily Odostomiinae
    - *Odostomia deplexa* (Tate & May, 1900)
    - *Linopyrga pascoei* (Angas, 1867)
    - *Linopyrga portseaensis* (Gatliff & Gabriel, 1911)
    - *Pseudoskenella depressa* Ponder, 1973
  - Subfamily Syrnolinae
    - *Syrnola bifasciata* Tenison Woods, 1875
    - *Syrnola tincta* Angas, 1871
  - Subfamily Turbonillinae
    - *Cingulina spina* (Crosse & Fischer, 1864)
    - *Pyrgiscus fuscus* (A. Adams, 1853)
    - *Turbonilla beddomei* (Petterd, 1884)

Observations

Odostomia deplexa (Tate & May, 1900)

Material: One specimen, sieved intertidally from among mud and *Zostera* seagrass, Crawfish Rock, Western Port Bay, Victoria, Friday 28 November, 2006. Collected by R. Burn. Museum Victoria reference number F113533.

Shell (Fig. 1a): The shell is 2.9mm long, elongate and smooth, semi-opaque and very light yellowish-white in colour. The protoconch is not prominent and appears insert, and the columella bears one small plication. There is a very narrow, indistinct umbilicus behind the columellar reflection. The operculum is elongate oval, sturdy,and brownish-yellow with no spiral markings.

Animal (Fig. 2a): The animal is semi-opaque white, with the cephalic tentacles semi-translucent white and lightly tinged lemon-yellow. There are occasional fine cream-white spots on the dorsal foot and mentum; on the central head behind the eyes these are densely aggregated, forming a whitish patch. The cephalic tentacles are long and delicate, flattened along their length, each bearing a small semi-translucent tentacular pad at the outer end. The eyes are black and the mentum is small, smoothly rounded with no notch. The extended foot is two-thirds to three-quarters of the shell length, bi-lobed anteriorly, wider centrally, and bluntly rounded posteriorly. The sole bears a very faint cleft in its midline, commencing at mid length and extending posteriorly but not reaching the end. The extended animal sits relatively low in the dorso-ventral plane, and crawls with a smooth, gliding motion.

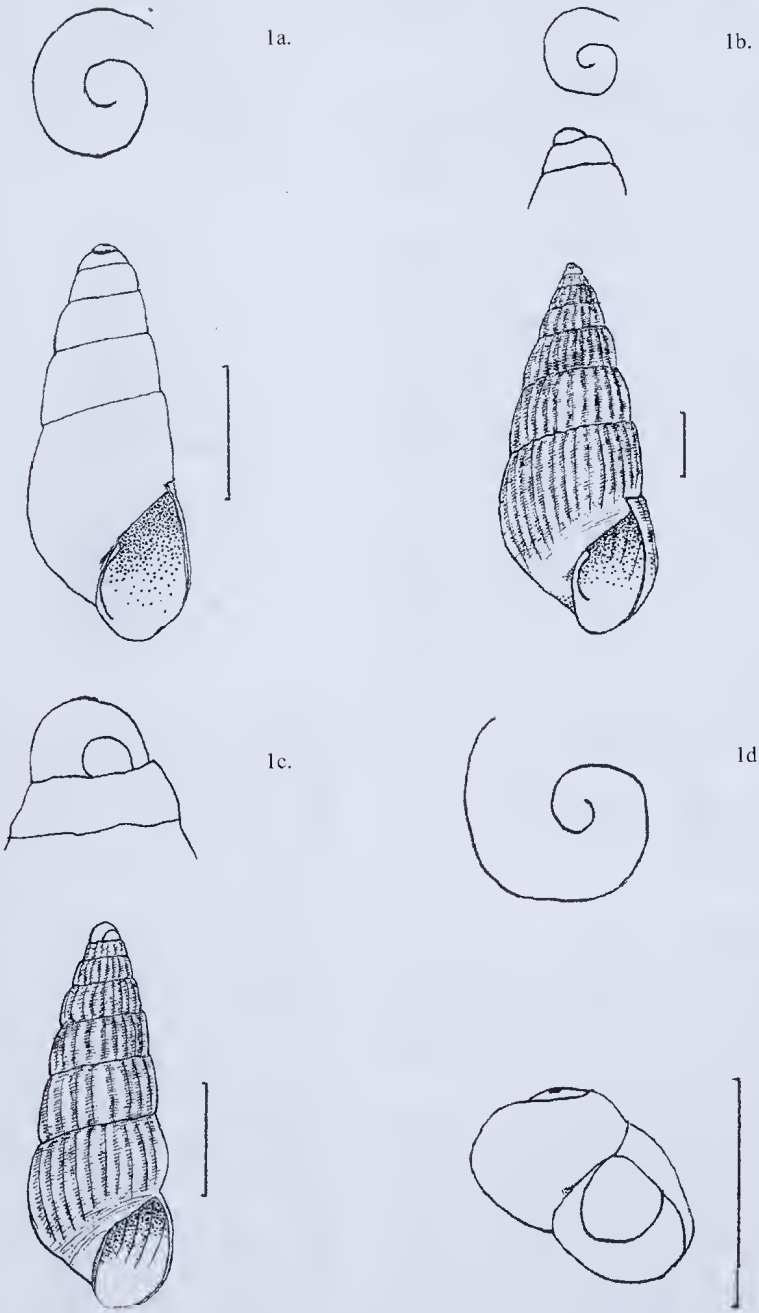


Fig. 1. Drawings of shells (scale lines indicate 1.0 mm) and protoconchs above each shell (not to scale). a). *Odostomia deplexa* (Tate & May, 1900) (protoconch viewed from above). b). *Linopyrga pascoei* (Angas, 1867) (protoconch viewed from side and above). c). *Linopyrga portseaensis* (Gatliff & Gabriel, 1911). d). *Pseudoskenella depressa* Ponder, 1973 (protoconch viewed from above; retracted operculum visible inside aperture).

Distribution: It is found from Victoria to South Australia, including Tasmania (Cotton, 1959).

***Linopyrga pascoei* (Angas, 1867)**
Material: One specimen, intertidally, from West Cape, Cape Conran (just east of boat ramp), Victoria, 1 March, 2006. Collected by R. Burn. Museum Victoria reference number F113531.
Shell (Fig. 1b): The shell is 5.5 mm long, sturdy and opaque white. The whorls bear axial ribs and many microscopic spiral striae, with the former fading anteriorly on the body whorl. Laseron (1951) observed the axial ribs traversing the length of the body whorl, but Angas (1867) described them as fading anteriorly. The columella bears a plication and the protoconch from above appears insert. No observations have been made on the operculum.
Animal (Fig. 2b): The animal was sluggish and microscopic examination has not occurred. Observations here are restricted to those of the animal being white, with black eyes situated near the midline. Hedley (1916) offers a brief description and diagram of the living animal, noting it to be uniform cream in colour with black eyes, with the animal creeping away from light.
Distribution: It is found in New South Wales (Jansen, 1995), with this record extending the range to eastern Victoria (Burn, pers. comm.).

***Linopyrga portseaensis* (Gatliff & Gabriel, 1911)**
Material: One specimen, intertidally, from West Cape, Cape Conran (just east of boat ramp), Victoria, 1 March, 2006. Collected by R. Burn. Museum Victoria reference number F113530.
Shell (Fig. 1c): The shell is 3.4 mm long, opaque white and more slender than *L. pascoei*. The whorls bear axial ribs and many microscopic spiral striae, the latter continuing to the anterior aspect of the body whorl. The columella lacks a plication and the protoconch is angled, partially engulfed by the succeeding teleoconch whorl, and somewhat worn so that detail is not clear. No observations have been made on the operculum.
Animal (Fig. 2c): The animal was sluggish and microscopic examination has not occurred. It has been photographed extended, and, on this basis, limited observations are offered. The animal is white, the cephalic tentacles are relatively short and somewhat triangular in outline, the eyes are black and situated centrally, the mentum is long and extends beyond the anterior foot. The end of the mentum is notched centrally and laterally expanded.

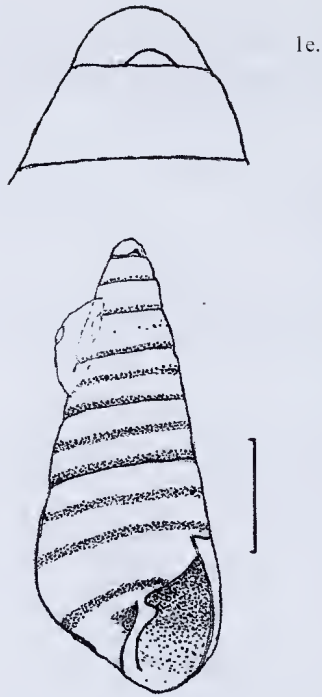
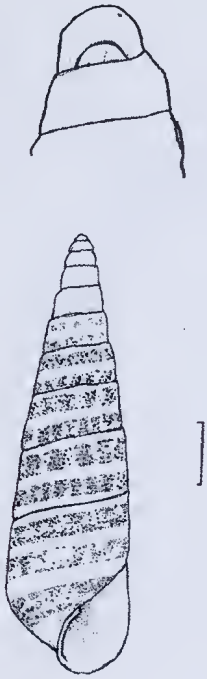


Fig. 1 (cont'd). Drawings of shells (scale lines indicate 1.0 mm) and protoconchs above each shell (not to scale). e). *Syrnola bifasciata* Tenison Woods, 1875. f). *Syrnola tincta* Angas, 1871. g). *Cingulina spina* (Crosse & Fischer, 1864). h). *Pyrgiscus fuscus* (A. Adams, 1853) (Cape Conran specimen). i). *Turbonilla beddomei* (Petterd, 1884) (Blanket Bay specimen).

Burn (unpubl.) has observed and figured a specimen of *Linopyrga* cf. *portseaensis* collected from *Enteromorpha* algae at Point Danger, Torquay, Victoria, noting a white animal, with his figure agreeing well with the overall form shown in the photograph of Fig. 2c. Burn's (unpubl.) figure shows a mentum that is grooved along the length of its midline. Burn (unpubl.) has also collected *Linopyrga* cf. *portseaensis* intertidally from Point Danger Torquay on

1f.



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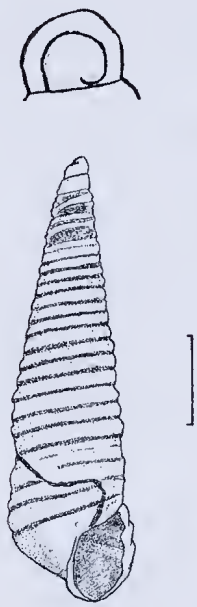

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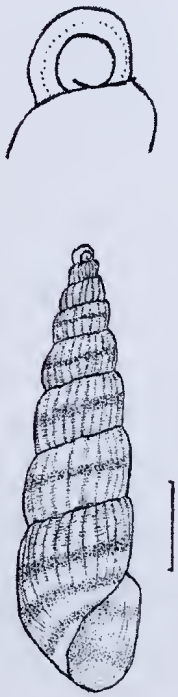


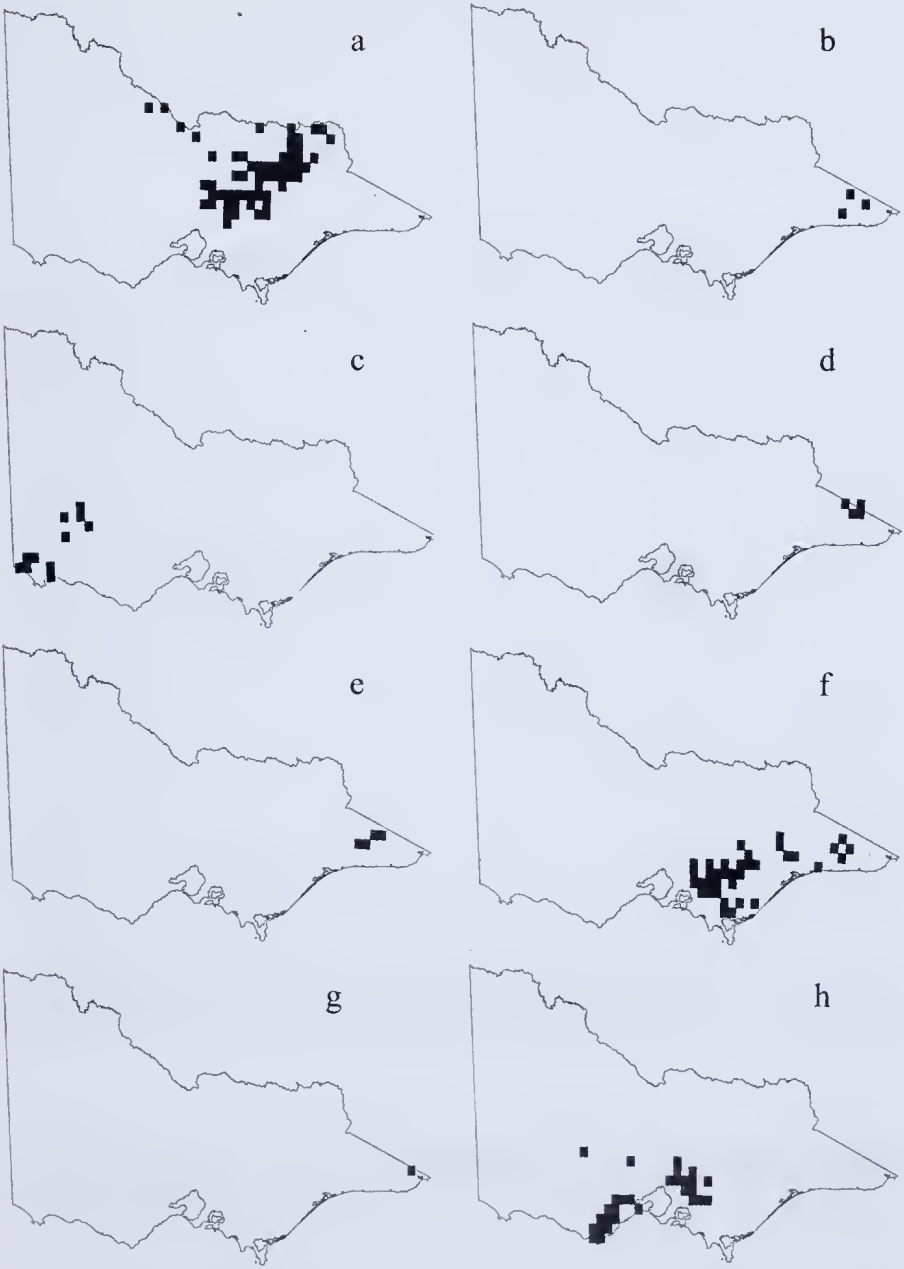
1i.

Amphibolis seagrass, and also intertidally from Point Lonsdale on algae.
Distribution: It is found in Victoria and Tasmania (Cotton, 1959), and probably also in New South Wales (Laseron, 1951).

***Pseudoskenella depressa* Ponder, 1973**
Material: Two specimens, on the polychaete tube worm *Galeolaria caespitosa* Lamarck, 1818 in the mid-littoral zone, Waratah Bay, Victoria, 19 September, 2005. Collected by P. Vafiadis. Museum Victoria reference number F113327.
Shell (Fig. 1d): The shells are thin, smooth, flatly globose, colourless, transparent, and 1.0 mm wide. The apices of the shells appear insert. The sutures are well defined, the aperture is ovate and the umbilicus shallow. There is a thin, glassy operculum.
Animal (Figure 2d): This has been described and figured by Ponder (1973) and also noted by Burn (1974a) and Burn and Bell (1976), the latter having found it among *G. caespitosa* collected from eight different Victorian localities from Portland in the west to Shallow Inlet in the east. The animal is semi-opaque white, with semi-translucent white cephalic tentacles. It has a yellowish mantle organ flecked with brown spots, visible through the dorsum of the shell. Brown visceral organs are visible beneath the early whorls. The cephalic tentacles each distally bear a small, transparent tentacular pad. The eyes are black and the mentum is not notched. The proboscis was not seen everted, but Ponder (1973) reports it to be three times the shell length when fully extended. The dorsal propodium bears a white transverse ridge and the sole a faint posterior midline cleft. The extended foot is equal to or slightly longer than the shell. The animal is active, crawling with a smooth, gliding motion. The foot does not protrude beyond the posterior shell when crawling. It feeds parasitically on its host, the tube worm *G.caespotisa*, and has also been found on algae and under stones (Ponder, 1973).
Distribution: It is found in eastern Australia from Queensland to Victoria (Ponder, 1973), including Tasmania (Burn and Bell, 1976). Because *G. caespitosa* also occurs in South Australia and Western Australia (Edgar, 1997), it seems feasible that *P. depressa* may also occur there.

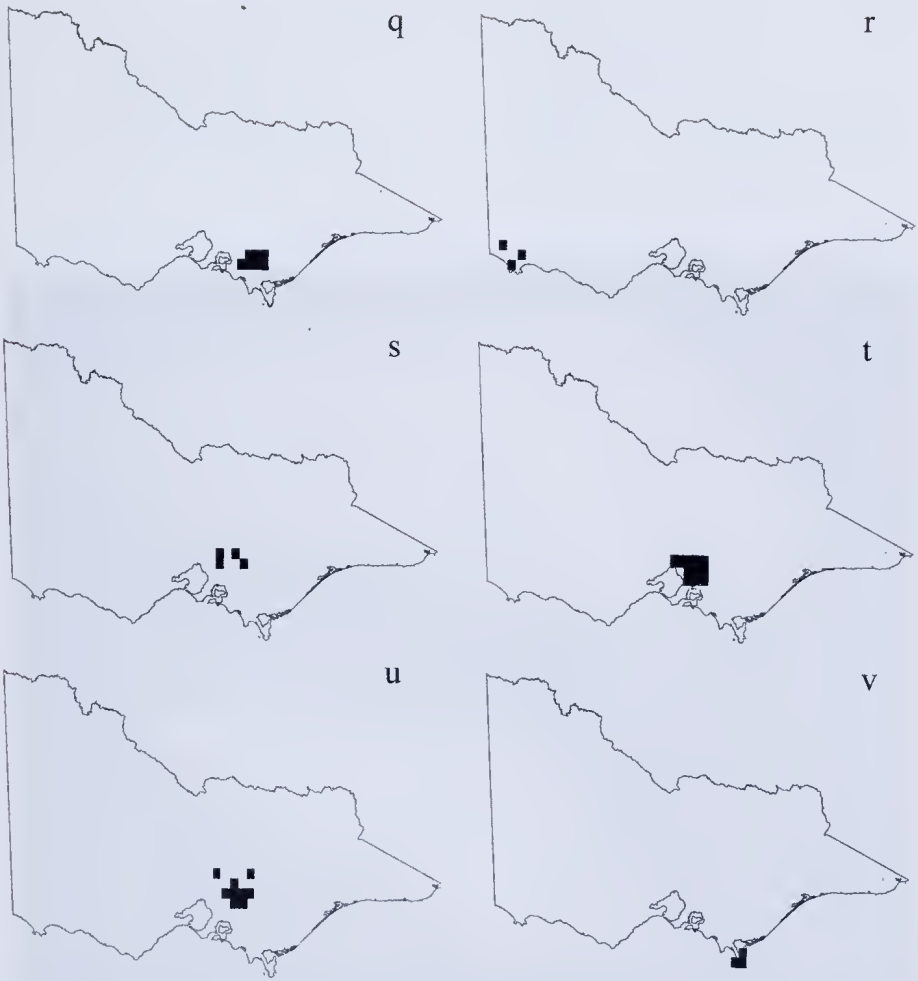
***Syrnola bifasciata* Tenison Woods, 1875**
Material: Two specimens, sieved intertidally from among mud and *Zostera* seagrass, Crawfish Rock, Western Port Bay, Victoria, Friday 28 November, 2006. Collected by R. Burn. Museum Victoria reference number F113532.
Shell (Fig. 1e): The shells are 4.2 mm and 4.0 mm long, white, elongate, semi-opaque and smooth. The protoconch is largely concealed by the first teleoconch whorl. The teleoconch whorls bear two brown spiral bands, one centrally and the other just above the suture, with a third band on the body whorl. The columella has one prominent plication and there is a triangular umbilicus. The operculum is translucent and yellow-brown. On preservation, the retracted animals have left seven-eighths of the body whorl vacant, exposing areas of white calcareous thickening on the inner dorsal body whorl.
Animal (Fig. 2e): The animal is semi-opaque white, sparsely dotted with spots of cream-white on the cephalic tentacles, mentum and dorsal foot; on the head behind each eye these cream-white spots are densely aggregated, and extend posteriorly out of view under the anterior shell margin. The cephalic tentacles are broad, flattened along their length, and taper to a blunt point, without tentacular pads. The eyes are black and the prominent mentum tapers outwards distally, and is widely grooved along the length of its midline. It is held in front of the anterior foot when crawling. The extended foot is about three quarters of the shell length and the sole is broader anteriorly and bears no clefts or visible openings. The animal crawls with a smooth, gliding motion.

Burn (unpubl.) has figured and recorded this species alive from among *Caulerpa* algae at Point Lonsdale Victoria, agreeing with the above, except that the mentum of the Point Lonsdale specimen does not taper outwards at its distal end and is not shown to be prominently grooved along the length of its midline. Burn (unpubl.) has also recorded this species alive from Port Albert, Victoria, and from New South Wales.



Distribution maps of *Euastacus* species. a. *Euastacus armatus*. b. *Euastacus bidawalus*. c. *Euastacus bispinosus*. d. *Euastacus claytoni*. e. *Euastacus diversus*. f. *Euastacus kershawi*. g. *Euastacus yanga*. *h. Euastacus yarraensis*.

Distribution maps of *Euastacus* species.
i. *Euastacus crassus*. j. *Euastacus woiwuru*.
k. *Euastacus neodiversus*.



Distribution maps of *Engaeus* species. q. *Engaeus phyllocercus*. r. *Engaeus strictifrons*. s. *Engaeus tuberculatus*. t. *Engaeus victoriensis*. u. *Engaeus affinis*. v. *Engaeus australis*.

Distribution maps of *Engaeus* species. a. *Engaeus cunicularius*. b. *Engaeus curvisuturus*. c. *Engaeus cymus*. d. *Engaeus fultoni*. e. *Engaeus urostrictus*. f. *Engaeus merosetosus*. g. *Engaeus orientalis*. h. *Engaeus hemicirratulus*.

Distribution maps of *Engaeus* species. i. *Engaeus karnanga*. j. *Engaeus laevis*. k. *Engaeus lyelli*. l. *Engaeus mallacoota*. m. *Engaeus quadrimanus*. n. *Engaeus rostrogaleatus*. o. *Engaeus sericatus*. p. *Engaeus sternalis*.

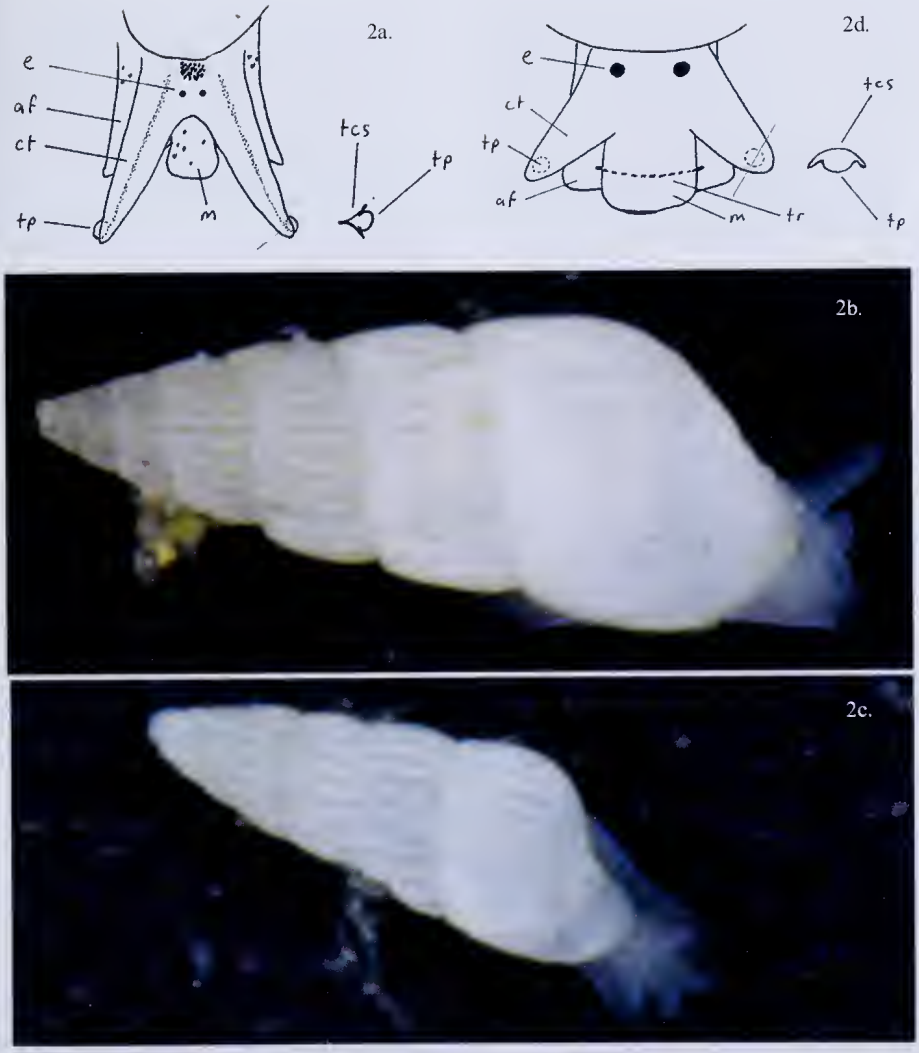


Fig. 2. Head and anterior foot views. Not to scale relative to each other. Dotted lines on the cephalic tentacles represent a ventral edge visible through the tentacle. Dotted lines in *Pseudoskenella depressa* indicate the transverse ridge visible through the mentum. Key: af - anterior foot; ct - cephalic tentacle; e - eye; m - mentum; tp - tentacular pad; tr - transverse ridge; tcs - transverse cross section through the left cephalic tentacle as indicated. (a). *Odostomia deplexa (*Tate & May, 1900), (b). Entire animal of *Linopyrga pascoei* (Angas, 1867), (c). Entire animal of *Linopyrga portseaensis* (Gatliff & Gabriel, 1911), (d). *Pseudoskenella depressa* Ponder, 1973.

Distribution: It is found in south-eastern Australia from central New South Wales to South Australia, including Tasmania (Jansen, 1995; Cotton, 1959).

***Syrnola tincta* Angas, 1871**

Material: One specimen, collected intertidally at Blanket Bay, Victoria, 15 February, 2004, by A. Falconer. Museum Victoria reference number F113328.

Shell (Fig. 1f): The shell is cream white, opaque, smooth, and 6.9 mm long. The protoconch is smooth and heterostrophic. The teleoconch whorls are smooth except for microscopic longitudinal growth scratches, and patterned by faint broken

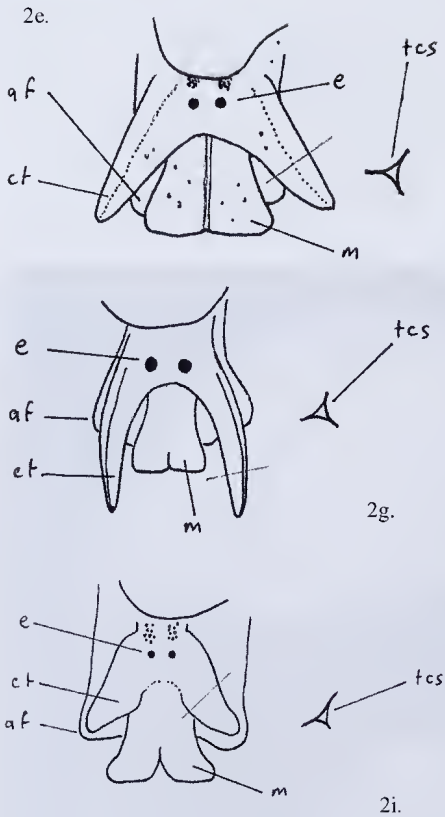


Fig. 2 (cont'd). Head-and anterior foot views. Not to scale relative to each other. Dotted lines on the cephalic tentacles represent a ventral edge visible through the tentacle. Key: af - anterior foot; ct - cephalic tentacle; e - eye; m - mentum; tcs - transverse cross section through the left cephalic tentacle as indicated. e). *Syrnola bifasciata* Tenison Woods, 1875, f). *Syrnola tincta* Angas, 1871, g). *Cingulina spina* (Crosse & Fischer, 1864), h). *Pyrgiscus fuscus* (A. Adams, 1853), (Shallow Inlet specimen), i). *Turbonilla beddomei* (Petterd, 1884), (Cape Conran specimen stretching forwards; cephalic cross section is based on Blanket Bay specimen).

bands of light yellow-brown, two per whorl between the sutures, three on the body whorl. Over time in the preserved state, the banding seems to have slightly faded. The operculum is thin, slightly yellowish, and translucent. Cotton and Godfrey (1932) report a colourless form of this species, as well as some variation in shell shape.

Animal (Fig. 2f): The animal is semi-translucent white, dotted with spots of cream-white. The cephalic tentacles are relatively short and dotted distally with spots of cream-white. They are flattened along their length, with a midline notch between them suggested when they are held laterally. The eyes are black and the mentum is long, prominent and notched but not outwardly tapering. The extended foot is at least three-quarters of the shell length, expanded anteriorly, rounded posteriorly, with the sole smooth and bearing a single, midline, opaque white spot (possibly a glandular opening) just posterior to its mid-length.

Distribution: It is found in southern and eastern Australia from Queensland to southern Western Australia, including Tasmania (Cotton, 1959).

Cingulina spina (Crosse & Fischer, 1864)

Material: One specimen, sieved from shallow sublittoral seagrass/algae, Cleeland Bight, Phillip Island, Victoria, 24 January, 2004. Collected by A. Falconer. Museum Victoria reference number F113329.

Shell (Fig. 1g): The shell is yellowish-white, elongate, and 5.0 mm long. The protoconch is smooth and sinistral. Each teleoconch whorl has three spiral ribs, with fine, microscopic axial scratches between them. The sutures are indistinct. The specimen shows signs of significant repair after damage. The operculum is thin, semi-

transparent, brown, oval, with no spiralling or concentric patterning, and about half the area of the aperture.

Animal (Fig. 2g): The animal is uniformly semi-opaque white. Brownish visceral organs are visible beneath the first six whorls. The cephalic tentacles are long, tapering, and flattened along their length. The eyes are prominent and black. The mentum is long, notched and outwardly tapering. There is a fold of thin, transparent tissue beneath the shell on the right side, possibly a short siphon (Wise, 1996; Fretter and Graham, 1949). The extended foot is slightly less than half the shell length, gently tapering to a blunt point posteriorly, and acutely expanded anteriorly. The sole is semi-opaque white, smooth, with a fine midline cleft posteriorly. The animal crawls in a slow, inching fashion.

Burn (unpubl.) has figured and observed this species alive from Victoria at Yanakie, Corner Inlet; and also from southern New South Wales, agreeing with the above, with the additional observation of a cream lens within each eye-spot in the Victorian specimen. Burn (unpubl.) has also recorded this species alive from Victoria at Shallow Inlet, Torquay, and Clifton Springs.

Distribution: It is found along southern Australia from central New South Wales to southern Western Australia, including Tasmania (Jansen, 1995; Cotton, 1959).

***Pyrgiscus fuscus* (A. Adams, 1853)**

Material: Four specimens, sieved from sand in littoral pool, East Cape (just east of boat ramp), Cape Conran, Victoria, 1 March, 2006. One specimen, sieved from muddy silt in a patch of *Zostera* seagrass, shallow sub-littoral zone, Shallow Inlet (western bank), Waratah Bay, Victoria, 27 September, 2006. All collected by P. Vafiadis. Museum Victoria reference numbers F113330 and F113331 respectively.

Shell (Fig. 1h): The shell is elongate and delicate. The Cape Conran specimens are 5.0 mm, 5.0 mm, 4.6 mm and 4.5 mm long, and the Shallow Inlet specimen is 3.5 mm long. The Cape Conran shells are somewhat translucent, light brown, with a brown band on each whorl, and another at the suture line, the latter continuing past the aperture as a second spiral band on the body whorl and extending to the outer lip. A third brown band arises from the columellar area before fading laterally. The Shallow Inlet specimen is uniform brown throughout. The protoconch is smooth and sinistral and the teleoconch whorls have fine axial ribs along their length, and closely set microscopic spiral lirae. The columellar fold is not prominent, and there is no umbilicus. The operculum is ovoid, thin, translucent yellowish, and non-spiral. The preserved animals have all retracted to leave three-quarters of the body whorl vacant.

Animal (Fig. 2h): The Cape Conran animals are semi-opaque white with some pink tinge on the head, and an entirely pink foot; some specimens have occasional flecks of white on the upper mentum. The Shallow Inlet specimen was semi-opaque white throughout with occasional flecks of white on the mentum, dorsal foot, head and cephalic tentacles. Brownish viscera are visible beneath the first six teleoconch whorls of the Cape Conran specimens, and a long black streak visible through the body whorl dorsally may represent the pigmented mantle organ. The cephalic tentacles are relatively short, triangular, flattened along their length, and held upright during crawling. The eyes are black and the mentum is long and notched. The more translucent Cape Conran shells showed pulsating cardiac tissue (dorsally, just posterior to the body whorl suture) beating at an averaged rate of 88 per minute in one specimen. The expanded foot is half the shell length, and the sole is entirely smooth. The crawling motion is smooth and gliding.

Burn (1974b) has studied preserved specimens of *P.* from Port Phillip Bay, Victoria, noting the animals to be buff in colour, with short, tapering and laterally hollowed cephalic tentacles, large centrally-placed eyes and an oval, transparent operculum. Burn (unpubl.) has observed and roughly figured this species alive from Portland, Victoria, noting a pinkish animal with white patches behind the eyes, and in form agreeing with the above. Burn (unpubl.) has also recorded this species alive from Victoria at Shallow Inlet.

Distribution: It is found in south-eastern Australia from southern New South Wales to southern Western Australia, including Tasmania (Cotton, 1959).

***Turbonilla beddomei* (Petterd, 1884)**

Material: One specimen collected intertidally at Blanket Bay, Victoria, 15 February, 2004 by A. Falconer. One specimen, sieved from short corallinc algae in lower littoral pool, Cowrie Bay, Cape Conran, Victoria, 27 February, 2006, by P. Vafiadis. Museum Victoria reference numbers F113332 and F113529 respectively.

Shell (Fig. 1i): The shell is semi-translucent white, of length 3.6 mm and 4.1 mm in the Blanket Bay and Cape Conran specimens, respectively. The protoconch is smooth and sinistral. The teleoconch whorls have smooth axial ribs which fade anteriorly on the body whorl. There is no spiral sculpture. The operculum is thin, yellowish, and translucent.

Animal (Fig. 2i): The animal is opaque. The Blanket Bay specimen is pink throughout, and the Cape Conran specimen is similar, although more reddish in hue. Two cream-coloured streaks extend posteriorly behind each eye on the Cape Conran specimen. In the Blanket Bay specimen, the right cephalic tentacle and right eye are missing. The cephalic tentacles are flattened along their length and meet in the midline. The mentum of the Cape Conran specimen is prominent, long and notched (it being short and weakly notched in the Blanket Bay specimen). Viewed aperturally, pulsating cardiac tissue is visible beneath the more translucent shell of the Blanket Bay specimen, at and posterior to the body whorl suture. Here, auricle and ventricle were seen to rhythmically alternate in size at approximately 41 beats per minute. The foot is relatively short, wider anteriorly and bluntly rounded posteriorly. The sole bears a very fine cleft in its posterior midline. The animal crawls by inching.

Burn (unpubl.) made some brief observations on a specimen of *T. beddomei* collected intertidally at Bancoora Reef, Breamlea, Victoria, on 30 December, 2001 (Museum Victoria reference number F113528), noting the animal to be pinkish with short, triangular cephalic tentacles.

Distribution: It is found in southern Australia, from New South Wales to southern Western Australia, including Tasmania (Cotton, 1959).

General notes

The Pyramidelloideans are a large group of specialised gastropods positioned taxonomically 'between' the higher prosobranchs and the opisthobranchs. They are generally small and live as ectoparasites on a range of invertebrate hosts to which they attach with a specialised buccal apparatus that pierces the external epithelium and allows the snail to suck the body fluids of the host (Fretter and Graham, 1949; Wise, 1996; Ponder and de Keyzer, 1998). A radula is lacking, not being needed in their specialized parasitic role (Fretter and Graham, 1949; Fretter, *et al.*, 1986; Wise, 1996; Ponder and de Keyzer, 1998).

The pyramidellid shell is variably shaped, with the protoconch showing a change in the direction of coiling called heterostrophy (Fretter and Graham, 1949; Fretter, *et al.*, 1986; Wise, 1996; Ponder and de Keyzer, 1998). Two forms of heterostrophy are recognized – sinistral and dextral. In sinistral heterostrophy, the protoconch coils sinistrally before a transition to dextral coiling begins. In dextral heterostrophy, the direction of coiling remains constant as in conventional dextral shells; however, unlike conventional dextral shells, this constant dextral coiling occurs upwards in the developing protoconch and then downwards as usual in the teleoconch, thereby enclosing the protoconch. In such an arrangement, the protoconch appears sinistral if re-oriented (i.e. turned upside down) and viewed in the conventional manner. Fretter *et al.* (1986) call this arrangement a 'pseudosinistrality' or 'dextral hyperstrophy'. Wise (1996) calls this same arrangement 'dextral heterostrophy'.

More information about the interesting biology of pyramidellids is contained in the references provided.

Conclusion

The heterostrophic protoconch, medially placed eyes, longitudinally flattened (instead of cylindrical) cephalic tentacles, and prominent mentum are sufficient external characters, visible through a hand

lens, to enable recognition of pyramidelloidean molluscs in the field. Many are known only from the shell, and more data are needed on their soft anatomy, host organisms and mode of life.

Acknowledgements
Many thanks are due to many people. Robert Burn has collected, donated and identified specimens, and has provided valuable comments, references and personal unpublished field notes on an extensive variety of pyramidellid snails. He has also read and made valuable comments on an earlier version of this paper. His presence and expertise in the field resulted directly in the discovery and collection of the *Pyrgiscus fuscus* specimens from Cape Conran, Victoria. He also brought the existence of *Pseudoskenella depressa* to my attention, inspiring me to look for it. I am greatly indebted to him. Audrey Falconer has donated specimens she has collected in the field for further study. Lynton Stephens has lent dry specimens of *Syrnola bifasciata* from his personal collection for comparative study, helping to clarify certain questions of identification, and provided the Bouchet and Rocroi (2005) reference. Clarrie Handreck has provided guidance and important comments on an early draft of this paper, and has lodged the specimens formally into the Marine Invertebrate Collection of Museum Victoria. Robin Wilson, David Staples, Chris Rowley and the other staff of the Marine Invertebrate Department, Museum Victoria, have provided much appreciated general support, including access to the library and microscopes to produce the shell drawings. I also thank the anonymous reviewer of this article for guidance which has further improved it.

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The diverse land snail community of Bruxner Park on the north coast of New South Wales, Australia

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Abstract

Australia has a diverse land snail fauna of international significance. This short paper presents the results of a study of the land snails of Bruxner Park, a small conservation reserve near Coffs Harbour on the NSW North Coast, and provides information on the range of interesting land snail species found there. Bruxner Park is one of the richest known sites for land snail diversity on the NSW North Coast, with 30 species recorded to date and more likely to occur there. This high diversity is particularly notable given the acidic, calcium-poor nature of the soils present. (*The Victorian Naturalist* **124** (5), 2007, 306-309)

Introduction

Australia has a rich native land snail fauna with an estimated several thousand species in 25 families (Stanisic 1994; Stanisic and Ponder 2004). The fauna comprises an ancient Gondwanan element (probably over 100 million years old) and a relatively recent (less than 15 million years old) Asian element (Smith and Kershaw 1979; Bishop 1981). The majority of species occur in rainforests, where long-term moisture stability and the diversity of available microhabitats have supported the evolution and survival of complex land snail communities (Stanisic 1994). The rainforests of the north coast of New South Wales (NSW) provide some of the most interesting areas to study land snails in Australia (Shea 1978). An example of the land snail community found in one such area is briefly presented here to help promote a wider appreciation of the region's diverse and significant land snail fauna.

Study Area and Methods

Bruxner Park Flora Reserve (30°15'S, 153°06'E) is a 407 hectare conservation reserve near the city of Coffs Harbour, in Gumbaynggirr Aboriginal country in the NSW north coast bioregion. The vegetation of the reserve is mainly subtropical rainforest and moist eucalypt forest with a few small areas of dry eucalypt forest, on an underlying geology of metamorphosed shale. The climate is subtropical maritime, with an average annual rainfall of about 2000 mm, peaking in late summer/autumn (Forestry Commission of NSW 1989).

A field study of the land snails and slugs of Bruxner Park was done between December 1998 and November 2001, sampling the range of vegetation types present. Survey methods comprised lifting and replacing ground debris such as logs and loose rocks, hand-raking leaf litter, examination of tree trunks and vegetation and searching around rocks used as anvils by the Noisy Pitta *Pitta versicolor*, as well as searches by torchlight for active animals on wet nights. Searching was done over a total of about 35 hours on about 60 separate days or nights. Reference was also made to the Australian Museum (Sydney) and Queensland Museum (Brisbane) collections for records of additional species from the study area.

Results and Discussion

Thirty species from eight families were recorded in Bruxner Park (see Table 1). This is a high species diversity for a site in the NSW north coast region. Typical land snail species diversities in the region are 10–20 species for rainforest sites and about five species for dry eucalypt forest sites (Stanisic 1994). The few sites in the region where rainforest occurs on limestone have had up to 39 species recorded per site (Stanisic 1997). Non-limestone rainforest sites can also have very high land snail species diversities but, with population densities lower than in limestone areas, detecting all species present takes a greater search effort (De Winter and Gittenberger 1998; Schilthuizen and Rutjes 2001). Overall land

Table 1. Land snails and slugs of Bruxner Park. Nomenclature based on Smith (1992).

Athoracophoridae
Triboniophorus graeffei Humbert, 1863

Camaenidae
Austrochloritis bellengerensis (Cox, 1871)
Austrochloritis brevipila (Pfeiffer, 1849)
Thersites novaehollandiae (Gray, 1834)
Posorites conscendens (Cox, 1866)
Ventopelita leucocheilus (Cox, 1868)
Camaenidae species A

Caryodidae
Brazieresta larreyi (Brazier, 1871)
Hedleyella falconeri (Gray, 1834)

Charopidae
Hedleyoconcha delta (Pfeiffer, 1857)
Macrophallikoropa belli (Cox, 1864)
Ngairea corticicola (Cox, 1866)
Setomedea seticostata (Hedley, 1924)
Charopidae species A
Charopidae species B
Charopidae species C
Charopidae species D

Helicarionidae
Coneuplecta calculosa (Gould, 1852)
Nitor medioximus Iredale, 1941
Parmavitrina megastoma (Cox, 1868)
Wilhelminaia mathildae Preston, 1913
Helicarionidae species A
Helicarionidae species B

Punctidae
Iotula microcosmos (Cox, 1868)
Paralaoma caputspinulae (Reeve, 1851)

Rathouisiidae
Atopos australis Heynemann, 1876

Rhytididae
Saladelos macquariensis Cox, 1872
Rhytididae species A
Rhytididae species B
Rhytididae species C

snail abundance at Bruxner Park was only low and further sampling, particularly including litter sorting and shrub beating, would be expected to identify additional species including several which are known from the local area. A total land snail fauna of around 35–40 species for Bruxner Park would be a reasonable estimate. Solem (1984) noted that there were few locations in the world in which land snail diversity exceeds 30 species.

The most speciose families in the Bruxner Park land snail community are the Charopidae, Camaenidae and Helicarionidae, reflecting the dominance of these families in the eastern Australian land snail fauna (Stanisic 1994). Most species were recorded from rainforest areas, with fewer found in moist eucalypt forest and very few found in dry eucalypt forest. About one third of the species recorded are currently undescribed. This is not unusual in Australia, where many hundreds of land snail species await formal description (Stanisic and Ponder 2004). Also not unusual is the absence of introduced species, which dominate the land snail fauna of Australian urban and agricultural areas but are generally scarce or absent from areas of intact native vegetation (Simpson and Stanisic 1986; Ponder 1997).

Some of the interesting species found in Bruxner Park are illustrated. *Triboniophorus graeffei* (Fig. 1), commonly known as the red triangle slug, climbs smooth-barked eucalypt trees at night and leaves distinctive feeding trails up to 10 metres high on tree trunks as it grazes on microscopic algae and fungi growing on the bark surface. It usually hides in leaf litter and under fallen timber by day, although it can sometimes be seen active on overcast or wet days. *Thersites novaehollandiae* (Fig. 2) is a partly arboreal rainforest snail that is endemic to the NSW north coast region. It can be seen at night active on the forest floor or on tree trunks up to 6 metres above the ground. A clutch of eggs and hatchlings of this species was found under a fallen log in rainforest in January. The undescribed camaenid species A (Fig. 3) was first noted as a distinct new taxon following examination of specimens collected during this field work. It belongs to the *Meridolum-Galadistes* species group of dry-adapted land snail species and has a narrow distribution, occurring only in the Coffs Harbour local area. In Bruxner Park the species is restricted to the small areas of fire-prone dry eucalypt forest where it is usually found sheltering under loose rocks. *Brazieresta larreyi* (Fig. 4) is another

Fig. 1. *Triboniophorus graeffei* (body 140 mm)

Fig. 2. *Thersites novaehollandiae* (shell 40 mm)

Fig. 3. Undescribed Camaenidae species A (shell 28 mm)

NSW north coast endemic and is found on the forest floor in rainforest and moist eucalypt forest. It has a thin, fragile shell attractively patterned with darker markings. *Hedleyella falconeri* (Fig. 5) is one of Australia's largest native land snails. Tracking of snails by spool-and-line (Murphy 2002) indicated that the species is nomadic, moving randomly around the rainforest floor at night (up to 22 metres in a single night), and hiding by day buried under leaf litter or occasionally in cavities under fallen timber. Large spherical eggs almost 20 millimetres in diameter are laid in clutches in a hollow in damp soil below the leaf litter, where they sometimes fall prey to the carnivorous slug *Atopos australis*. Adult *H. falconeri* and *T. novaehollandiae* were commonly recorded as prey items of the Noisy Pitta at Bruxner Park. *Parmavitrina megastoma* (Fig. 6) is one of a group of helicarionid species with reduced shells which are commonly referred to as semi-slugs. This species is found in moist eucalypt forest and exudes a distinctive beetroot-coloured mucus when disturbed. Other interesting land snails not illustrated include the charopids and punctids, small to medium-sized litter-dwelling snails often with ornately sculptured shells, and the rhytidids, carnivorous land snails which actively pursue and prey on other snails.

Bruxner Park is significant as one of the richest known sites for land snail diversity on the NSW north coast. The land snail community of Bruxner Park is a noteworthy component of the overall biodiversity, playing an important role in the Reserve's ecology, and provides a good example of the range of interesting land snail species to be found in the region.

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My children Sam, Jess and Nicola helped with the field survey. John Stanisic and Darryl Potter helped with identification of specimens and provided records from the Queensland Museum. Michael Shea, Ian Loch and Alison Miller provided records from the Australian Museum. Michael Shea, John Stanisic, Darryl Potter and an anonymous reviewer provided helpful comments on earlier drafts of the paper. This study was done under Special Purposes Permit No. 05445 provided by Forests NSW.

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Fig. 4. *Brazieresta larreyi* (shell 38 mm)

Fig. 5. *Hedleyella falconeri* (shell 100 mm)

Fig. 6. *Parmavitrina megastoma* (body 40 mm)

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One hundred and one years ago

A RARE VICTORIAN ORCHID.– Some twelve years ago I was fortunate enough to find near Oakleigh an orchid which, on examination by the late Baron von Mueller, proved to be new, and which he named *Prasophyllum dixoni* (*Vict. Nat.*, ix., 44) in honour of my companion, Mr. J. E. Dixon, a well-known member of our Club. Only two specimens were found at the time, and I have searched for this orchid every year since without success until last month, when I again found it, in the district between Oakleigh and Cheltenham. No other records for this orchid seem to exist. – C. French, Jun. 19th June, 1906.

From *The Victorian Naturalist* XXIII p. 79, July 5, 1906

The sole Tasmanian record of the Elbow Orchid *Thynninorchis huntianus* (F. Muell.) D.L. Jones & M.A. Clem.

The Elbow Orchid *Thynninorchis huntianus* (F. Muell.) D.L. Jones & M.A. Clem. was collected from a small scrub remnant in Smith's Gully on Flinders Island on 3 January 1972. The site and associated species are detailed below. The area has since been cleared. The specimen remains the sole Tasmanian record to date.

The Site and Discovery

Smith's Gully is the main north-eastern valley of the granite Strzelecki massif in the south-western corner of Flinders Island. Most of the valley's floor, and the level ground to the boundary north of it, were cleared before the late 1960s. Dimmock (1957) mapped the area as falling within the Loccota Soil Type. He summarised this as 'Various angular grits and other soils on granite detritus.' However, he gave no detail about the Smith's Gully area, and confined his comments to the strip along the western, south-western and southern bases of the Strzelecki massif, which he assessed as the major occurrence of Loccota soil.

The Smith's Gully farm includes all the valley and extends a little way to the north. By 1972 there were two cottages just south of the farm's northern boundary and a small scrub remnant had been left beside the western one. The taller part had Manuka *Leptospermum scoparium* and the Tasmanian endemic Whip-stick Teatree *Leptospermum glaucescens* as the dominant shrubs. Their understorey, which ranged in height from 45 to 60 cm, was Common Heath *Epacris impressa,* Rock Teatree *Kunzea ambigua,* South-eastern Broom-heath *Monotoca glauca* and Golden Pea *Aotus ericoides.* The herbs that could be named were the Forked Comb-fern *Schizaea bifida,* Errienellum *Drosera peltata* var. *auriculata* and the Purple Beard-orchid *Calochilus robertsonii.* The other orchids were too over-developed to be determined but were a sun-orchid *Thelymitra* sp., a *Caladenia* and a Leek-orchid *Prasophyllum* sp..

At the narrow gap between this area and shorter growth was a single plant of an orchid novel to Maureen Christie and me. At a glance it looked like a dead sundew *Drosera* sp. It brought the name *Spiculea* to mind for one of us and, at home, it turned out – using Nicholls (1969) – to be the Elbow Orchid *Spiculea huntiana.*

Later, Mr Eric Warren, the owner of the property, told me that he thought the former eucalypts of the site were probably White Gums *Eucalyptus viminalis.* However, this seemed to be based on the eucalypts elsewhere on the block rather than actual observation at the site. I inspected the locality on 25 February 2006. The scrub remnant starting about 30 metres west of the site has Shining Peppermint *Eucalyptus nitida* dominant over old and decaying Whip-stick Teatree. The same eucalypt is the only dominant in an old scrub patch just north-west in the adjacent property. It is also the only eucalypt in the major remnant of bush starting about 200 metres west of the site. It is also the nearest dominant to the south. However, there is a small group of White Gums at about 150 metres south-west of the site.

Later Searches and Status

When I checked the site in the mid-1970s there was no trace of the orchid. Mr Wayne Warren, a resident of Smiths Gully, searched the surviving scrub patches during the following season but his search was fruitless too (Wayne Warren, pers. comm.).

Since 1972, my collecting has continued on Flinders Island and 99 other islands between Wilsons Promontory and the north-eastern corner of mainland Tasmania. My vascular plant specimens passed 13 000 in December 2006. However, there are many tens of thousands of hectares of Shining Peppermints, with a major understorey of Whip-stick Teatree, on Flinders Island but very little work seems to have been done in them at the flowering time of the Elbow Orchid. To date this species still remains known in Tasmania by just the

single plant collected in January 1972. So the orchid is appropriately scheduled, under the Tasmanian *Threatened Species Protection Act 1995*, as endangered.

Extension of the species' range

The nearest Australian mainland site is near Wonthaggi in Victoria. The Tasmanian locality at Smith's Gully extends the species' range some 210 kilometres to the south-east.

The Specimen

3.i.1972, Smith's Gully, Flinders Island, at 0594839, 5550532; 40° 11' 24·5", 148° 06' 50·8" (Datum AGD66; estimated error: 7 metres). John Whinray C2011 & Maureen Christie; CANB 332344.

The current generic name of the Elbow Orchid was assigned by Jones *et al.* (2002).

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Birds of the Long Forest 1889 – 2005

by Marilyn Hewish, Rosemary Ward, Rohan Bugg and David Munday

Publisher: *Friends of Werribee Gorge and Long Forest Mallee Inc C/- Parks Victoria, 219 Main Street, Bacchus Marsh, Vic 3340. ISBN 0 9581200 3 X, RRP $40.90*

The 'Long Forest' of the title of this book is the Long Forest Nature Conservation Reserve, north of the Western Highway between Melton and Bacchus Marsh, and selected areas in its vicinity. This area is unique and important because it contains outliers of Mallee vegetation at least 100 km from the main Victorian distribution and separated by the Great Dividing Range. This wonderful book is a lot more than an annotated list of birds and where to find them. For the past 25 years the authors and birdwatchers from many organisations have studied the bird community of the Long Forest in detail. This area has been a birdwatcher's paradise since the 1880s when the train line was extended to Melton. The book also includes painstakingly researched historical records of birds in the area and biographies of three early, well-known birdwatchers.

Many years ago my husband and I owned a block of bushland on the Diggers Rest-Coimadai Road. How I wish we still had it. It was very close to Lake Merrimu and the Long Forest and I recall the bitter conservation battle when part of the Long Forest, with its unique Mallee vegetation, was subdivided for large housing blocks. In an act of generosity demonstrating great forethought, Bill Wilson purchased 148 ha in 1977. This was ultimately transferred to the Crown and became the first part of the Long Forest Reserve. The reserve has since been enlarged and, as a small remnant, the Long Forest is a treasure trove of plants and animals. Let's hope that addi-

tions to the reserve are a continuing process.

The woodlands of the area have undergone extensive clearing, fragmentation and incremental degradation, as have woodlands everywhere in Victoria. Habitat clearing negatively affects all plants and animals but is particularly detrimental to birds, and in the last 100 years several Long Forest species have become locally extinct. Mentioned in the book are Australian Bustards, Bush Stone-curlews, White-browed and Grey-crowned Babblers, Plains-wanderers, Southern Whitefaces and Hooded Robins. I'm sure this sad and sorry tale of local extinction is familiar to birdwatchers everywhere.

The long-term bird study has unearthed some remarkable and important aspects about the Long Forest for bird conservation. Three of its treasures are isolated populations of dry-country birds – the Crested Bellbird, the Chestnut-rumped Thornbill and the Yellow-rumped Pardalote (a subspecies of the Spotted Pardalote). These birds regularly use the Mallee vegetation of the Long Forest. The first two species are difficult to find and sightings are rare, as they comprise very small, isolated and vulnerable island populations. The Yellow-rumped Pardalotes are easier to find and are probably the most secure of the trio.

The Long Forest is also a haven for many birds of national and state conservation significance. Many other bird species, which are at risk because they have declined or become extinct in parts of their range, but are not yet listed, also use the reserve for migratory flyways, feeding, roosting and in some cases breeding. As an entity, the Victorian Woodland Bird Community has been classified as threatened under the *Flora and Fauna Guarantee Act 1988,* and the Long Forest is an important safe haven for woodland birds of the region.

Birds, which have probably become extinct or are in precipitous decline in the region, are Australian Bustards (last seen around the 1960s), Bush Stone-curlews (not recorded since 1991), Plains-wanderers (only rarely seen by the 1960s and 1970s), White-browed Babblers (declined from plentiful in 1939 to 'couldn't be found' in 1951), Grey-crowned Babblers (last known record 1954), Southern Whitefaces (no records since 1969), Hooded Robins (in 1969 reported as in sharp decline and only a few seen since), Rainbow Lorikeets (probably shot as an orchard pest) and Regent Honeyeaters (now nationally endangered, probably never to be seen again in the Long Forest). What a sad loss.

During the prolonged drought of the 1990s to 2003, the Long Forest was an important drought refuge for many birds, some species appearing in the remnant for the first time in years. There were influxes of several species not normally seen in high numbers, such as Fuscous and Crescent Honeyeaters, Musk, Little and Purple-crowned Lorikeets and the *piece de resistance*, Swift Parrots. 2003 also saw an irruption of the altitudinal migrant, the Flame Robin, prompted by either the widespread drought or wildfire within the species' breeding range.

During the drought many species of migratory bird also used the remnant. The usually uncommon Pallid Cuckoo arrived in large numbers from 1999 to 2001. A few Leaden Flycatchers appeared, and there were higher numbers of a normally

irregular and rare visitor, the White-winged Triller, which arrived at the Long Forest and attempted to breed.

Of course the Long Forest is not alone in supporting many avian species, especially during adverse periods such as drought. What this does illustrate though, is the importance of all small remnants for avian conservation. This book provides a perfect example of why remnants of native vegetation, even when small, should be nurtured and expanded.

The book is nicely illustrated with black and white and coloured photographs and several useful maps, and concludes with an annotated list of the 174 species recorded during the intensive surveys of 1981-2005. Historical records from 1889 for each species are also included. I enjoyed dipping into the list and quickly looked up the woodland bird of special interest to me, the Noisy Miner. What a relief – only four records! The presence of Noisy Miners in higher numbers would certainly damage the Long Forest's usefulness as a haven for small birds.

This book will be of enormous interest not only to local natural history aficionados, but also to anyone interested in birds, woodland ecology, and avian conservation. As the authors point out, the book is 'a celebration of the Long Forest'. And what a wonderful place to celebrate! It's close to Melbourne, makes a great day trip and, if you're lucky, you might find some marvellous ornithological gems.

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Impact of the 2002/03 alpine wildfires on *Dasyurus maculatus* in East Gippsland

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Abstract
Known Spotted-tailed Quoll latrines were searched for the presence of scats after the 2002/03 alpine wildfires burnt through the upper Snowy River area in eastern Victoria. Quolls were detected only at sites that either did not burn or were patchily burnt. Quolls were still not detected in areas that were burnt intensely three years after the fires. The implications of the survey results suggest that the species could have suffered a 35-50% population decline due to the fires. (*The Victorian Naturalist* **124** (5), 2007, 313-315)

Introduction

The upper Snowy River and tributaries constitute the stronghold in Victoria for *Dasyurus maculatus,* the Tiger or Spotted-tailed Quoll, and contains more than 54% of repeat records since 1980 (Atlas of Victorian Wildlife 2006). *Dasyurus maculatus* has been studied and monitored in the Suggan Buggan Valley since 1990 (Belcher 1994; 1995; 1998; 2000; 2003; Belcher and Darrant; 2004; 2006a; 2006b). The alpine wildfires in 2002/03 burnt through the Suggan Buggan Valley, Rocky Range through to Mt Tingaringy in February 2003.

Dasyurus maculatus use latrines (communal defecation sites) to potentially mark territory, landscape features and to denote presence and reproductive status (Belcher 1994; Kruuk and Jarman 1995). The presence of active latrines is a reliable method of determining the presence/absence of *D. maculatus*. The main latrine at Mt Stradbroke was checked in April 2003 and several burnt scats were present. A survey of known latrines in the study area was conducted to investigate the impact of the fire on the species.

Methods

Five known latrines were searched for scats to provide evidence of the species'

presence. Searches were undertaken in April 2003, February-March and October 2004, October 2005 and July 2006. The Mt Stradbroke and Hanging Rock sites were searched each year. The other sites were surveyed at least once between 2003 and 2006. Sites searched included Mt Stradbroke, Hanging Rock, Suggan Buggan Valley, Rocky Plains Creek, Langhams Bluff, Little River, Snowy River between Willis and Sandy Waterholes Track and Sandy Waterholes Track.

Presence/absence then was compared to fire intensity. Fire intensity was considered high if the crown was burnt or scorched, moderate if the understorey was burnt and low if the ground cover and shrubs were burnt.

The sites including the White Box *Eucalyptus albens* woodland on the eastern side of the Snowy River were assessed to determine fire intensity and to ground truth the DSE fire map of the area.

Results

Fire Intensity

Fire intensity was highest along the escarpment and ridge tops along the Rocky Range. The floor of the Suggan Buggan River valley was patchily burnt and fire intensity varied from low to high, depending on aspect and topography. Tributaries such as Rocky Plains Creek and especially the rocky outcrops on the eastern side burnt intensely. The Little River valley and particularly the gorge were either unburnt or lightly burnt. Similarly, much of the Snowy River valley was either unburnt or patchily burnt at low intensity. East of the Snowy River to Mt Tingaringy, most of the White Box woodland, with the exception of Gattamurah Creek, was burnt intensely.

Quoll Records

Quoll scats were found at Langhams Bluff, Little River and the Snowy River opposite Gattamurah Creek. Incidental records included a sighting on the Snowy River Rd near Gattamurah Ck (JK Rogers pers. comm.) and a trap record in the Little River Gorge (DSE records).

Quoll scats and sightings/trapping occurred at sites that were either unburnt or patchily burnt at low intensity. Sites where quolls were not recorded included the north-facing escarpment along the Suggan Buggan Valley, which was subjected to high to extreme fire intensity.

Fire Impact

Approximately 90% of the white box/cypress pine on both sides of the Snowy River burnt intensely (DSE fire map). The only areas either unburnt or burnt patchily were sections of the Suggan Buggan Valley, Gattamurah Creek, the Snowy River valley and Little River Gorge.

Dasyurus maculatus records from the Atlas of Victorian Wildlife over the last 25 years were analysed to determine the proportion of the Victorian population recorded from the upper Snowy River area. Only locations with multiple records (>1) from specific locations were included in the analysis as these records were most likely to indicate resident rather than transient or displaced quolls. The analysis found that 54.8% of multiple records from specific sites during the last 25 years were from the upper Snowy River area. The results of the present surveys indicate that no animals survived where the fires were severe. In NSW around Jacobs River, where the fire varied from intense to patchy and the adjoining Snowy River valley was largely unburnt, 25% of the pre-fire *D. maculatus* population was recorded 3 months after the fire (Dawson 2005). Therefore the impact of the fire in the upper Snowy River on the *D. maculatus* population would be a reduction of between 67.5% if 25% survived the fires and 90% if no animals survived the fires. The impact on the state population, without taking into account the impact of the 2003 fires from the north-east through the Alps and Gippsland, would be between 37% (54.8% of 67.5) and 49% (54.8% of 90). Given the endangered status and ongoing decline in range and abundance of the species in Victoria, a sudden decline of that magnitude should be cause for immediate concern and action.

Discussion

The upper Snowy River area is the remaining stronghold for *D. maculatus* in Victoria. This is supported by the number of records over the last 25 years (Atlas of Victorian Wildlife) and the fact that it is the only area in Victoria where *D. macula-*

tus has been trapped in the last 25 years. Trapping surveys in the Otways, south-west Victoria and north-east Victoria in the last 10 years have not resulted in the capture of any quolls (Belcher 1999; DSE records).

Previous studies (Belcher 1994; Belcher 2000) had found that quolls used the escarpment and the gullies running off the escarpment extensively for movement, hunting and denning. Wildfires are typically more intense travelling up slopes than travelling down, so it was not surprising that the steep gullies and north-facing escarpment burnt intensely, while the floor of the valleys burnt less intensely or patchily.

Quolls were recorded denning in rock caves, crevices and boulder tumbles along the escarpment (Belcher 1994). The absence of quolls on the escarpment would suggest that they did not survive the fire, even though they may have been sheltering in rock dens. Quolls did survive in areas that were unburnt, patchily burnt or burnt at low intensity.

The fact that quolls and their prey were still absent from the escarpment more than three years after the fire supports the conclusion that they did not survive the fire and is reason for concern, given their nationally endangered status (*Environment Protection and Biodiversity Conservation* Act 1999) and slow rate of recolonisation.

The unburnt and patchily burnt areas of the upper Snowy River and tributaries such as Gattamurah Creek, and the Snowy River between Willis and Campbell's Knob, should be surveyed to determine the species' post-fire distribution and to enable monitoring of recovery and the rate of recolonisation. The Suggan Buggan/Rocky Range sites should be surveyed annually to monitor the species' recovery in order to assess the impact of high intensity fires on the species.

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